Molecular Characterization of DOM in Indian Ocean Hydrothermal Systems

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Oceans harbor the largest dissolved organic matter (DOM) pool on our planet. The major fraction of DOM in the deep-ocean is recalcitrant and resistant to degradation. Under hydrothermal conditions, this recalcitrant DOM can be reworked, altered or removed. However, little is known about the molecular composition of natural deep-sea hydrothermal DOM along hydrothermal pathways. We investigated the molecular composition of DOM from hot fluids, diffuse fluids and plumes in the Kairei and the newly discovered Pelagia deep-sea hydrothermal systems located on the Central Indian Ridge and the Southeast Indian Ridge, respectively. We combined geochemical analyses with ultra-high resolution mass spectrometry (FT-ICR-MS) to molecularly characterize the DOM. Hot fluids were clearly distinguished from diffuse fluids, plumes and surrounding deep seawater. Dissolved organic sulfur (DOS) and nitrogen (DON) were 17% and 6% enriched in both Kairei and Pelagia hot fluids compared to background seawater. This result indicates selective hydrothermal degradation of seawater DOM or, alternatively, the preferential formation of nitrogen and sulfur-containing compounds under hydrothermal conditions. In addition, DOM in both hot fluids clearly exhibited reduced properties and a higher degree of unsaturation than DOM in diffuse fluids and plumes. The DOM molecular composition in our natural hot fluids was very different from that of experimental samples exclusively exposed to abiotic thermal degradation [1] suggesting the prevalence of other, possibly biotic processes in natural systems.

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